

CPC**COOPERATIVE PATENT CLASSIFICATION****E02D**

FOUNDATIONS; EXCAVATIONS, EMBANKMENTS (specially adapted for hydraulic engineering E02B); **UNDERGROUND OR UNDERWATER STRUCTURE** (tunnels, tunnelling, mining E21)

WARNING

The following IPC groups are not used in the CPC scheme. Subject matter covered by these groups is classified in the following CPC groups:

[E02D 29/09](#) covered by [E02D 29/06](#)

E02D 1/00

Investigation of foundation soil in situ (investigation involving boring or specially adapted to earth drilling [E21B 25/00](#), [E21B 49/00](#); investigating or analysing materials by determining their chemical or physical properties, in general [G01N](#), e.g. sampling [G01N 1/00](#))

E02D 1/02

. before construction work

E02D 1/022

.. {by investigating mechanical properties of the soil ([E02D 1/027](#) takes precedence)}

E02D 1/025

... {combined with sampling}

E02D 1/027

.. {by investigating properties relating to fluids in the soil, e.g. pore-water pressure, permeability (sampling of groundwater [E02D 1/06](#))}

E02D 1/04

.. Sampling of soil {([E02D 1/025](#) takes precedence)}

E02D 1/06

.. Sampling of ground water

E02D 1/08

. after finishing the foundation structure {(testing of piles [E02D 33/00](#))}

E02D 3/00

Improving or preserving soil or rock, e.g. preserving permafrost soil (securing of slopes or inclines [E02D 17/20](#); damming or interrupting passage of underground water [E02D 19/12](#); improving soil for agricultural purposes [A01](#); soil stabilisation for road building or like purposes [E01C 21/00](#), [E01C 23/10](#); setting rock anchoring bolts [E21D](#))

E02D 3/005

. {Soil-conditioning by mixing with fibrous materials, filaments, open mesh or the like}

E02D 3/02

. Improving by compacting ([E02D 3/11](#) takes precedence; compacting soil locally before or while forming foundations [E02D 27/26](#), [E02D 27/28](#))

E02D 3/026

.. by rolling with rollers usable only for or specially adapted for soil compaction, e.g. sheepfoot rollers (rollers for soil working in agriculture [A01B 29/00](#); rollers for road paving, such rollers usable also for compacting soil [E01C 19/23](#))

E02D 3/0265

... {Wheels specially adapted therefor; Cleats for said wheels}

E02D 3/032

... Trench rollers

E02D 3/039

... Slope rollers

E02D 3/046

.. by tamping or vibrating, e.g. with auxiliary watering of the soil ([E02D 3/026](#), [E02D 3/08](#) take precedence; generating or transmitting mechanical vibrations for

- performing mechanical work in general [B06B](#); tamping or vibrating apparatus for working ballast or railways [E01B 27/00](#), for consolidating paving materials [E01C 19/30](#), for consolidating concrete in general [E04G 21/06](#))
- E02D 3/054 . . . involving penetration of the soil, e.g. vibroflotation
- E02D 3/061 . . . Tampers with directly acting explosion chambers ([pile drivers with explosion chambers E02D 7/12](#))
- E02D 3/068 . . . Vibrating apparatus operating with systems involving reciprocating masses ([E02D 3/054](#), [E02D 3/061](#) take precedence)
- E02D 3/074 . . . Vibrating apparatus operating with systems involving rotary unbalanced masses ([E02D 3/054](#) takes precedence)
- E02D 3/08 . . by inserting stones or lost bodies, e.g. compaction piles ([sand drains for soil compaction E02D 3/10](#); [stressing soil while forming foundations E02D 27/28](#))
- E02D 3/10 . . by watering, draining, de-aerating or blasting, e.g. by installing sand or wick drains ([E02D 3/11](#) takes precedence; [soil-penetrating vibrators with auxiliary watering E02D 3/054](#); [drainage of soil in general E02B 11/00](#))
- E02D 3/103 . . . {[by installing wick drains or sand bags](#)}
- E02D 3/106 . . . {[by forming sand drains containing only loose aggregates \(sand piles E02D 3/08\)](#)}
- E02D 3/11 . by thermal, electrical or electro-chemical means ([freezing soil for interrupting passage of underground water E02D 19/14](#))
- E02D 3/115 . . by freezing
- E02D 3/12 . Consolidating by placing solidifying or pore-filling substances in the soil ([making piles E02D 5/46](#); [soil-conditioning or soil-stabilising materials C09K 17/00](#); [consolidation of ground around boreholes or wells E21B 33/138B](#), [E21B 43/025](#))
- E02D 3/123 . . {[and compacting the soil \(E02D 3/126 takes precedence\)](#)}
- E02D 3/126 . . {[and mixing by rotating blades](#)}
- E02D 5/00** **Bulkheads, piles, or other structural elements specially adapted to foundation engineering** ([engineering elements in general F16](#))
- E02D 5/02 . Sheet piles or sheet pile bulkheads {([foundations made with sheet pile bulkheads E02D 27/30](#); [cofferdams E02D 19/04](#))}
- E02D 5/03 . . Prefabricated parts {[e.g. composite sheet piles](#)}
- E02D 5/04 . . . made of steel
- E02D 5/06 Fitted piles or other elements specially adapted for closing gaps between two sheet piles or between two walls of sheet piles
- E02D 5/08 Locking forms; Edge joints; Pile crossings; Branch pieces
- E02D 5/10 . . . made of concrete or reinforced concrete {([moulds therefor E02D 5/70](#))}
- E02D 5/105 {[of prestressed concrete \(E02D 5/12 takes precedence\)](#)}
- E02D 5/12 Locking forms; Edge joints; Pile crossings; Branch pieces
- E02D 5/14 . . Sealing joints between adjacent {[sheet](#)} piles ([sealing joints not restricted to foundation piles E04B 1/68](#))
- E02D 5/16 . . Auxiliary devices rigidly or detachably arranged on sheet piles for facilitating assembly {([as parts of driving or pulling apparatus E02D 7/00](#), [E02D 13/00](#))}
- E02D 5/18 . Bulkheads or similar walls made solely of concrete in situ {([moulds therefor E02D 5/68](#); [making foundation slots E02D 17/13](#); [sealing diaphragms other than those](#))}

- made of concrete [E02D 19/18](#)}}
- E02D 5/182 .. {using formworks to separate sections}
- E02D 5/185 .. {with flexible joint members between sections (joints in foundation structures [E02D 29/16](#); flexible joints in hydraulic engineering [E02B 3/16](#), in building [E04B 1/68](#))}
- E02D 5/187 .. {the bulkheads or walls being made continuously, e.g. excavating and constructing bulkheads or walls in the same process, without joints}
- E02D 5/20 . Bulkheads or similar walls made of prefabricated parts and concrete, including reinforced concrete, in situ
- E02D 5/22 . Piles (sheet piles, {i.e. elements shaped to mutually lock or mate}[E02D 5/02](#); {pile shoes [E02D 5/72](#); foundations on piles [E02D 27/12](#), [E02D 27/20](#))}
- E02D 5/223 .. {Details of top sections of foundation piles([E02D 5/54](#) takes precedence)}
- E02D 5/226 .. {Protecting piles (piles with protecting cases [E02D 5/60](#))}
- E02D 5/24 .. Prefabricated piles

NOTE

Documents covered both by [E02D 5/26](#) to [E02D 5/32](#) and by one or several of the groups [E02D 5/48](#) to [E02D 5/64](#) are classified in all relevant groups unless specific priority rules to the contrary are given

- E02D 5/26 ... made of timber with or without reinforcement; Means affording protection against spoiling of the wood (cases [E02D 5/60](#); impregnating agents [B27K 3/16](#)); Self-cleaning of piles placed in water
- E02D 5/28 ... made of steel {or other metals ([E02D 5/52](#) takes precedence)}
- E02D 5/285 {tubular, e.g. prefabricated from sheet pile elements (sheet pile boxes [E02D 27/30](#); concrete piles with metal casings [E02D 5/30](#))}
- E02D 5/30 ... made of concrete or reinforced concrete or made of steel and concrete {([E02D 5/50](#) takes precedence; assembled from segments [E02D 5/523](#); prestressed concrete [E02D 5/58](#))}
- E02D 5/32 ... with arrangements for setting {or assisting in setting} in position by fluid jets {(placing piers by using fluid jets in general [E02D 7/24](#))}
- E02D 5/34 .. Concrete or concrete-like piles cast in position; {Apparatus for making same ([E02D 5/50](#) takes precedence; moulds [E02D 5/665](#); placing, removing moulds [E02D 7/00](#) to [E02D 11/00](#); placing the concrete [E02D 15/04](#))}
- E02D 5/36 ... making without use of mouldpipes or other moulds

NOTE

Documents covered both by [E02D 5/34](#) to [E02D 5/46](#) and by one or several of the groups [E02D 5/48](#) to [E02D 5/64](#) are classified in all relevant groups unless specific priority rules to the contrary are given

- E02D 5/38 ... making by use of mould-pipes or other moulds
- E02D 5/385 {with removal of the outer mould-pipes (documents also covered by one or several of the groups [E02D 5/40](#) to [E02D 5/44](#) are classified in all the relevant groups)}
- E02D 5/40 in open water
- E02D 5/42 by making use of pressure liquid or pressure gas for compacting the

- concrete
- E02D 5/44 with enlarged footing or enlargements at the bottom of the pile
- E02D 5/445 {by application of pyrotechniques}
- E02D 5/46 . . . making in situ by forcing bonding agents into gravel fillings or the soil
(consolidating soil in general [E02D 3/12](#))
- E02D 5/48 . . Piles varying in construction along their length, {i.e. along the body between head and shoe, e.g. made of different materials along their length ([E02D 5/50](#), [E02D 5/52](#) take precedence)}
- E02D 5/50 . . Piles comprising both precast concrete portions and concrete portions cast in situ
{([E02D 5/523](#) takes precedence)}
- E02D 5/52 . . Piles composed of separable parts, e.g. telescopic tubes {Piles composed of segments}
- E02D 5/523 . . . {composed of segments}
- E02D 5/526 { Connection means between pile segments}
- E02D 5/54 . . Piles with prefabricated supports or anchoring parts; Anchoring piles {([E02D 5/44](#) takes precedence; ground anchors [E02D 5/80](#); anchored foundations [E02D 27/50](#))}
- E02D 5/56 . . Screw piles {(placing piles by screwing down [E02D 7/22](#))}
- E02D 5/58 . . Prestressed concrete piles {(segmental piles [E02D 5/523](#))}
- E02D 5/60 . . Piles with protecting cases
- E02D 5/62 . . Compacting the soil at the footing or in {or along} a casing by forcing cement or like material through tubes
- E02D 5/64 . . Repairing piles

- E02D 5/66 . Mould-pipes or other moulds {(for plant use [B28B](#))}
- E02D 5/665 . . {for making piles}
- E02D 5/68 . . for making bulkheads or elements thereof
- E02D 5/70 . . for making sheet piles {not used}

- E02D 5/72 . Pile shoes

- E02D 5/74 . Means for anchoring structural elements or bulkheads (anchoring piles [E02D 5/54](#); anchored foundations [E02D 27/50](#))
- E02D 5/76 . . Anchoring for bulkheads or sections thereof {in as much as specially adapted therefor}
- E02D 5/765 . . . {removable}
- E02D 5/80 . . Ground anchors {(for galleries, tunnels or shafts [E21D 21/00](#))}
- E02D 5/801 . . . {driven by screwing}
- E02D 5/803 . . . {with pivotable anchoring members}
- E02D 5/805 . . . {with deformable anchoring members}
- E02D 5/806 . . . {involving use of explosives}
- E02D 5/808 . . . {anchored by using exclusively a bonding material}

- E02D 7/00** **Methods or apparatus for placing sheet pile bulkheads, piles, mouldpipes, or other moulds** (for both placing and removing [E02D 11/00](#); {accessories for coupling driver to piles or the like [E02D 13/10](#); for trees or other plants [A01G 17/16](#); placing posts [E04H 17/26](#))

- E02D 7/02 . Placing by driving [{\(E02D 7/18 to E02D 7/24 take precedence\)}](#)
- E02D 7/04 .. Hand [{\(-actuated\)}](#) pile-drivers
- E02D 7/06 .. Power-driven drivers [{\(tamperers E02D 3/061\)}](#)
- E02D 7/08 ... Drop drivers with free-falling hammer [{\(E02D 7/10 takes precedence\)}](#)
- E02D 7/10 ... with pressure-actuated hammer, [{i.e. the pressure fluid acting directly on the hammer structure \(E02D 7/12 takes precedence; vibrating drivers E02D 7/18\)}](#)
- E02D 7/12 ... Drivers with explosion chambers
- E02D 7/125 [{Diesel drivers}](#)
- E02D 7/14 ... Components for drivers [{inasmuch as not specially for a specific driver construction}](#)
- E02D 7/16 Scaffolds [{or supports}](#) for drivers [{\(guide frames for the elements to be driven per se E02D 13/04; supports of the artificial island type E02B 17/00\)}](#)
- E02D 7/165 [{ of variable length, e.g. foldable or telescopic}](#)
- E02D 7/18 . Placing by vibrating [{\(vibrators for soil compacting E02D 3/046\)}](#)
- E02D 7/20 . Placing by pressure or pulling power
- E02D 7/22 . Placing by screwing down [{\(screw piles per se E02D 5/56\)}](#)
- E02D 7/24 . Placing by using fluid jets [{\(prefabricated concrete piles with arrangements therefor E02D 5/32\)}](#)
- E02D 7/26 . Placing by using several means simultaneously
- E02D 7/28 . Placing of hollow pipes or mould pipes by means arranged inside the piles or pipes [{\(E02D 13/08 takes precedence\)}](#)
- E02D 7/30 .. by driving cores

- E02D 9/00** **Removing sheet piles bulkheads, piles, mould-pipes or other moulds** [{or parts thereof}](#)[\(for both placing and removing E02D 11/00\)](#)
- E02D 9/005 . [{removing the top of placed piles of sheet piles \(E02D 9/04 takes precedence\)}](#)
- E02D 9/02 . by withdrawing
- E02D 9/04 . by cutting-off under water

- E02D 11/00** **Methods or apparatus** [{specially adapted}](#) **for both placing and removing sheet pile bulkheads, piles, or mould-pipes** [\(features relating to placing only E02D 7/00, to removing only E02D 9/00; {placing apparatus which without special provisions, can be operated to remove, e.g. vibrating drivers E02D 7/00}\)](#)

- E02D 13/00** **Accessories for placing or removing piles or bulkheads,** [{e.g. noise attenuating chambers}](#)
- E02D 13/005 . [{ Sound absorbing accessories in piling}](#)

- E02D 13/02 . specially adapted for placing or removing bulkheads
- E02D 13/04 . Guide devices; Guide frames **{(as parts of the driver scaffold [E02D 7/16](#))}**
- E02D 13/06 . for observation while placing
- E02D 13/08 . Removing obstacles
- E02D 13/10 . Follow-blocks of pile-drivers or like devices

NOTE

The IPC wording is replaced by the following wording: Devices adapted to, e.g. interposed on, the top of the pile to be driven, e.g. follow-blocks or the like caps, rings

E02D 15/00 Handling building or like materials for hydraulic engineering or foundations
{(soil-shifting [E02E](#);} conveying or working-up concrete or similar masses in general [E04G 21/02](#))}

- E02D 15/02 . Handling of bulk concrete specially for foundation **{(or hydraulic engineering)}** purposes **{(lining canals [E02B 5/02](#); banks of the bodies of water [E02B 3/121](#))}**
- E02D 15/04 . . Placing concrete in mould-pipes, pile tubes, bore-holes or narrow shafts
- E02D 15/06 . . Placing concrete under water **{(for surfacing the bottom of bodies of water [E02B 3/121](#))}**
- E02D 15/08 . Sinking workpieces into water or soil **{(inasmuch as not provided for elsewhere)}**
- E02D 15/10 . Placing gravel or light material under water **{(inasmuch as not provided for elsewhere)}**

E02D 17/00 Excavations; Bordering of excavations; Making embankments **(soil-shifting apparatus [E02E](#); earth drilling [E21](#))**

- E02D 17/02 . Foundation pits
- E02D 17/04 . . Bordering **{(surfacing)}** or stiffening the sides of foundation pits
- E02D 17/06 . Foundation **{(trenches)}** ditches or narrow shafts
- E02D 17/08 . . Bordering or stiffening the sides of ditches **{(trenches)}** or narrow shafts for foundations
- E02D 17/083 . . . **{(Shoring struts)}**
- E02D 17/086 . . . **{(Travelling trench shores)}**
- E02D 17/10 . . Covering trenches for foundations
- E02D 17/12 . . Back-filling of foundation trenches or ditches **{(apparatus therefor [E02F 5/12](#), [E02F 5/22](#))}**
- E02D 17/13 . Foundation slots **{(or slits)}**; Implements for making these slots **{(or slits)}**
- E02D 17/16 . Loosening of soil or rock, under water **(for correcting streams [E02B 3/02](#); by dredgers**

- or excavators [E02E](#))
- E02D 17/18 . Making embankments, {e.g. dikes, dams}{[E02D 17/20](#) takes precedence; {foundations for dams [E02D 27/40](#)}
- E02D 17/20 . Securing of slopes or inclines {(by soil [E02D 3/12](#); protection against snowslides or avalanches [E01F 7/04](#), [E01F 15/00](#); securing banks or like surfaces facing on bodies of water [E02B 3/12](#)}
- E02D 17/202 .. {with flexible securing means}
- E02D 17/205 .. {with modular blocks, e.g. pre-fabricated}
- E02D 17/207 .. {with means incorporating sheet piles or piles}
- E02D 19/00** **Keeping dry foundation sites or other areas in the ground** (sheet piles or bulkheads [E02D 5/02](#))
- E02D 19/02 . Restraining of open water
- E02D 19/04 .. by coffer-dams {e.g. made of sheet piles (permanent sheet piling boxes [E02D 27/30](#))}
- E02D 19/06 . Restraining of underground water
- E02D 19/08 .. by employing open ditches arranged below the level of the water
- E02D 19/10 .. by lowering level of ground water {(installation for obtaining or collecting drinking water [E03B 3/00](#))}
- E02D 19/12 .. by damming or interrupting the passage of underground water
- E02D 19/14 ... by freezing the soil (in connection with sinking shafts [E21D 1/12](#))
- E02D 19/16 ... by placing or applying sealing substances ({[E02D 19/18](#) takes precedence}; consolidating by placing solidifying or pore-filling pore-filling substances in the soil [E02D 3/12](#); {improving soil by chemical substances [C09K 17/00](#))}
- E02D 19/18 ... by making use of sealing aprons, {e.g. diaphragms made from bituminous or clay material}{concrete diaphragms [E02D 5/18](#); sealing or joints for {hydraulic} engineering work [E02B 3/16](#)}
- E02D 19/185 {Joints between sheets constituting the sealing aprons}
- E02D 19/20 ... by displacing the water, e.g. by compressed air {(pneumatic caissons [E02D 23/04](#))}
- E02D 19/22 . Lining sumps in trenches {or other foundation pits}
- E02D 23/00** **Caissons; Construction or placing of caissons** (tunnels submerged into or built in open water [E02D 29/063](#); {moles, piers, quays, breakwaters incorporating caissons [E02B 3/06](#); foundation formed by caissons [E02D 27/18](#) to [E02D 27/22](#); caisson-like artificial islands [E02B 17/00](#))}
- E02D 23/02 . Caissons able to be floated on water and to be lowered into water in situ {(floating caisson foundations [E02D 27/06](#))}
- E02D 23/04 . Pneumatic caissons {(sinking of same [E02D 23/10](#))}
- E02D 23/06 .. bringing persons or material into or out of compressed air caissons {(air locks in mines [E21F 1/14](#))}

- E02D 23/08 . Lowering or sinking caissons {(sinking mine shaft [E21D 1/00](#))}
- E02D 23/10 .. Caisson filled with compressed air {([E02D 23/06](#) takes precedence)}
- E02D 23/12 .. inclined lowering
- E02D 23/14 .. Decreasing the skin friction while lowering

- E02D 23/16 . Jointing caissons to the foundation soil, specially to uneven foundation soil

- E02D 25/00 Joining caissons, sinkers, or other units to each other under water**

- E02D 27/00 Foundations as substructures**

- E02D 27/01 . Flat foundations
- E02D 27/013 .. { Shuttering specially adapted therefor}
- E02D 27/016 .. { made mainly from prefabricated concrete elements}
- E02D 27/02 .. Flat foundations without substantial excavation ([E02D 27/04](#), [E02D 27/08](#) take precedence)
- E02D 27/04 .. in water or on quicksand
- E02D 27/06 ... Floating caisson foundations
- E02D 27/08 .. Reinforcements for flat foundations ([E02D 27/48](#) takes precedence)

- E02D 27/10 . Deep foundations
- E02D 27/12 .. Pile foundations
- E02D 27/14 ... Pile framings, {i.e. piles assembled to form the substructure}
- E02D 27/16 ... Foundations formed of separate piles
- E02D 27/18 .. Foundations formed by making use of caissons
- E02D 27/20 .. Caisson foundations combined with pile foundations
- E02D 27/22 .. Caisson foundations made by starting from fixed or floating artificial islands by using protective bulkheads

- E02D 27/24 . Foundations constructed by making use of diving-bells ([equipment for dwelling or working under water B63C 11/00](#))

- E02D 27/26 . Compacting soil locally before forming foundations; Construction of foundation structures by forcing binding substances into gravel fillings ([consolidating foundation soil in general E02D 3/02 to E02D 3/12](#); {for piles [E02D 5/02](#), [E02D 5/46](#)})

- E02D 27/28 . Stressing the soil or the foundation structure while forming foundations

- E02D 27/30 . Foundations made with permanent use of sheet pile bulkheads, walls of planks, or sheet piling boxes

- E02D 27/32 . Foundations for special purposes {(for paving of roads [E01C 3/00](#))}
- E02D 27/34 .. Foundations for sinking or earthquake territories ([building constructions with protection arrangements against earthquakes E04H 9/02](#))
- E02D 27/35 .. Foundations formed in frozen ground, e.g. in permafrost soil
- E02D 27/36 .. Foundations formed in moors or bogs

- E02D 27/38 . . Foundations for large tanks, e.g. oil tanks
- E02D 27/40 . . Foundations for dams across valleys or for dam constructions {(dams per se [E02B 3/10](#), [E02B 7/04](#))}
- E02D 27/42 . . Foundations for poles, masts or chimneys {(sockets or holders for poles or masts per se [E04H 12/22](#))}
- E02D 27/425 . . . { specially adapted for wind motors masts (wind motors per se [F03D 1/00](#))}
- E02D 27/44 . . Foundations for machines, engines or ordnance (special lay-out of foundations with respect to machinery to be supported [F16M 9/00](#))
- E02D 27/46 . . Foundations for supply conduits or other canals {(bridges for supporting conduits [E01D 18/00](#); elevated canals [E02B 5/005](#); penstocks [E02B 9/06](#))}
- E02D 27/48 . . Foundations inserted underneath existing buildings or constructions {(making a new substructure subsequent to lifting or moving of buildings [E04G 23/06](#))}
- E02D 27/50 . . Anchored foundations
- E02D 27/52 . . Submerged foundations, {i.e. submerged in open water ([E02D 27/12](#) to [E02D 27/24](#) take precedence)}
- E02D 27/525 . . . { using elements penetrating the underwater ground (sinking work pieces [E02D 15/08](#), sinking caissons [E02D 23/02](#))}

- E02D 29/00** {Independent} **underground or underwater structures** (underground tanks [B65D 88/76](#); hydraulic engineering, e.g. sealings or joints, [E02B](#); underground garages [E04H 6/00](#); underground air-raid shelters [E04H 9/12](#); burial vaults [E04H 13/00](#)); **Retaining walls**

- E02D 29/02 . Retaining or protecting walls (piers or quay walls [E02B 3/06](#))
- E02D 29/0208 . . {Gabions}
- E02D 29/0216 . . {Cribbing walls}
- E02D 29/0225 . . {comprising retention means in the backfill}
- E02D 29/0233 . . . {the retention means being anchors (details of anchors [E02D 5/80](#))}
- E02D 29/0241 . . . {the retention means being reinforced earth elements}
- E02D 29/025 . . {made up of similar modular elements stacked without mortar}
- E02D 29/0258 . . {not used, see subgroups ([E02D 29/0208](#) to [E02D 29/025](#) take precedence)}
- E02D 29/0266 . . . {made up of preformed elements}
- E02D 29/0275 . . . {cast in situ}
- E02D 29/0283 . . . {of mixed type}
- E02D 29/0291 . . . {made up of filled, bag-like elements}

- E02D 29/04 . Making large underground spaces, e.g. for underground plants, { e.g. stations of underground railways}; Construction or layout thereof ([E02D 29/10](#) takes precedence; { water-supply or sewerage plants [E03](#)}; layout of water power plants [E02B 9/00](#); making large underground chambers by underground methods only [E21D 13/00](#))

- E02D 29/045 . Underground structures, e.g. tunnels or galleries, built in the open air or by methods involving disturbance of the ground surface all along the location line; Methods of making them
- E02D 29/05 . . at least part of the cross-section being constructed in an open excavation or from the ground surface, e.g. assembled in a trench
- E02D 29/055 . . . further excavation of the cross-section proceeding underneath an already installed part of the structure, e.g. the roof of a tunnel

- E02D 29/06 . Constructions, or methods of constructing, in water {(E02D 15/00 takes precedence; submerged foundations E02D 27/52)}
- E02D 29/063 . Tunnels submerged into, or built in, open water (construction or placing of caissons in general E02D 23/00; joining caissons to each other under water, in general E02D 25/00)
- E02D 29/067 . . Floating tunnels; Submerged bridge-like tunnels, i.e. tunnels supported by piers or the like above the water-bed (pontoons or floating bridges E01D 15/14)
- E02D 29/07 . . Tunnels or shuttering therefor preconstructed as a whole or continuously made, and moved into place on the water-bed, e.g. into a preformed trench
- E02D 29/073 . . Tunnels or shuttering therefor assembled from sections individually sunk onto, or laid on, the water-bed, e.g. in a preformed trench (caisson-type sections lowered onto the water-bed E02D 29/077)
- E02D 29/077 . . Tunnels at least partially built beneath the water-bed characterised by being made by methods involving disturbance thereof all along the location line, e.g. by cut-and-cover or caisson methods
- E02D 29/08 . Siphons (for sewerage E03F 5/20; siphon weirs E02B 7/18; { siphons in general F04F 10/00})
- E02D 29/10 . Tunnels or galleries specially adapted to house conduits, e.g. oil pipe-lines, sewer pipes (for pressure water conduits E02B 9/06; { for cables H02G 9/02; layout of tunnels or galleries in general E21D 9/14; road kerbs with housings for pipes or the like E01C 11/222}); Making conduits in situ, e.g. of concrete (combined with digging of trenches or ditches E02F 5/10; { making or lining tunnels or galleries E21D; constructing tunnels or galleries in open excavations E02D 29/045; in open water E02D 29/063}); Casings, { i.e. manhole shafts, access or inspection chambers} or coverings of boreholes or narrow wells (wells for drinking water E03B 3/08; boreholes or wells formed by deep drilling E21B; shafts E21D)
- E02D 29/12 . Manhole shafts; Other inspection or access chambers; Accessories therefor (for underground tanks B65D 90/10; for sewerage E03F 5/02; { climbing irons or ladders E06C 9/00})
- E02D 29/121 . . { characterised by the connection between shaft elements, e.g. of rings forming said shaft}
- E02D 29/122 . . { Steps or handrails for shafts}
- E02D 29/124 . . { Shaft entirely made of synthetic material}
- E02D 29/125 . . { characterised by the lining of the shaft}
- E02D 29/127 . . { with devices for impeding fall or injuries of persons}
- E02D 29/128 . . { Repairs of manhole shafts}
- E02D 29/14 . . Covers for manholes or the like; Frames for covers {(gully gratings E03F 5/06)}
- E02D 29/1409 . . . { adjustable in height or inclination}
- E02D 29/1418 . . . { with implements to assist in lifting, e.g. counterweights, springs (lifting devices for covers B66F 19/005)}
- E02D 29/1427 . . . { Locking devices (of bayonet type E02D 29/14)}
- E02D 29/1436 . . . { with overflow or explosion control means, e.g. check or relief valves}
- E02D 29/1445 . . . { Tools for positioning or removing cover frames}
- E02D 29/1454 . . . { Non-circular covers, e.g. hexagonal, elliptic}
- E02D 29/1463 . . . { Hinged connection of cover to frame}

- E02D 29/1472 . . . { Cover entirely made of synthetic material}
- E02D 29/1481 . . . { Security devices, e.g. indicating unauthorised opening ([E02D 29/1427](#) takes precedence)}
- E02D 29/149 . . . { Annular gaskets}

- E02D 29/16 . . . Arrangement or construction of joints in foundation structures {{for hydraulic engineering [E02B 3/16](#)}; sealing joints not restricted to foundation structures [E04B 1/68](#)}

- E02D 31/00** **Protective arrangements for foundations or foundation structures** {{(protective casings for piles [E02D 5/60](#)); **Ground foundation measures for protecting the soil or the subsoil water, e.g. preventing or counteracting oil pollution** (spillage retaining means for tanks [B65D 90/24](#))}

- E02D 31/002 . . . {Ground foundation measures for protecting the soil or subsoil water, e.g. preventing or counteracting oil pollution (not used, see subgroups and [E02D 31/00](#))}
- E02D 31/004 . . . {Sealing liners}
- E02D 31/006 . . . {Sealing of existing landfills, e.g. using mining techniques}

- E02D 31/008 . . . {against entry of noxious gases, e.g. Radon}

- E02D 31/02 . . . against ground humidity or ground water {{[E02D 31/06](#) takes precedence; arrangements other than according to [E02D 31/04](#); against hydraulic pressure of groundwater [E02D 31/10](#)}
- E02D 31/025 . . . { Draining membranes, sheets or fabric specially adapted therefor, e.g. with dimples}
- E02D 31/04 . . . Watertight packings for use under hydraulic pressure {{(sealings for hydraulic engineering in general [E02B 3/16](#); for building structures in general [E04B 1/66](#))}

- E02D 31/06 . . . against corrosion by soil or water

- E02D 31/08 . . . against transmission of vibrations or movements in the foundation soil {{[E02D 27/34](#) takes precedence; foundations for machines, engines or ordnance [E02D 27/44](#); for road foundations [E01C 3/06](#)}

- E02D 31/10 . . . against soil pressure or hydraulic pressure {{(anchored foundations [E02D 27/50](#); joint sealings for use under hydraulic pressure [E02D 31/04](#))}
- E02D 31/12 . . . against upward hydraulic pressure
- E02D 31/14 . . . against frost heaves in soil

- E02D 33/00** **Testing foundations or foundation structures** (testing methods and apparatus, see the relevant subclasses of class [G01](#); testing structures or apparatus as regards function, in general, [G01M](#); testing or determining chemical or physical properties, in general [G01N](#))

- E02D 35/00** **Straightening, lifting, or lowering of foundation structures or of constructions erected on foundations** {{(foundations for sinking territories with incorporated means for remedying settlement [E02D 27/34](#); lifting or moving buildings [E04G 23/06](#))}

- E02D 35/005 . . . { Lowering or lifting of foundation structures}

E02D 37/00 **Repair of damaged foundations or foundation structures** {(renewing piles [E02D 5/64](#);
roads [E01C 11/005](#); bridges [E01D 22/00](#); repairing buildings [E04G 23/02](#)}

E02D 2200/00 **Geometrical or physical properties**

- E02D 2200/11 . Height being adjustable
- E02D 2200/115 .. with separate pieces
- E02D 2200/12 . corrugated
- E02D 2200/13 . having at least a mesh portion
- E02D 2200/14 . resilient or elastic
- E02D 2200/143 .. helically or spirally shaped
- E02D 2200/146 .. Springs
- E02D 2200/15 . including at least a hinge
- E02D 2200/16 . Shapes
- E02D 2200/1607 .. round, e.g. circle
- E02D 2200/1614 ... made from single element
- E02D 2200/1621 ... made from multiple elements
- E02D 2200/1628 .. rectangular
- E02D 2200/1635 ... made from single element
- E02D 2200/1642 ... made from multiple elements
- E02D 2200/165 .. polygonal
- E02D 2200/1657 ... made from single element
- E02D 2200/1664 ... made from multiple elements
- E02D 2200/1671 .. helical or spiral
- E02D 2200/1678 .. triangular
- E02D 2200/1685 .. cylindrical
- E02D 2200/1692 .. conical or convex
- E02D 2200/17 . including an electric conductive element

E02D 2220/00 **Temporary installations or constructions**

E02D 2250/00 **Production methods**

- E02D 2250/0007 . using a mold

- E02D 2250/0015 . using extrusion
- E02D 2250/0023 . Cast, i.e. in situ or in a mold or other formwork
- E02D 2250/003 . Injection of material
- E02D 2250/0038 . using an auger, i.e. continuous flight type
- E02D 2250/0046 . using prestressing techniques
- E02D 2250/0053 . using suction or vacuum techniques
- E02D 2250/0061 . for working underwater
- E02D 2250/0069 .. Welding
- E02D 2250/0076 .. Drilling
- E02D 2250/0084 .. using pneumatical means
- E02D 2250/0092 .. using hydraulical means

E02D 2300/00 Materials

- E02D 2300/0001 . Rubbers
- E02D 2300/0003 .. Car tires
- E02D 2300/0004 . Synthetics
- E02D 2300/0006 .. Plastics
- E02D 2300/0007 ... PVC
- E02D 2300/0009 ... PE
- E02D 2300/001 ... PP
- E02D 2300/0012 ... recycled
- E02D 2300/0014 ... PU
- E02D 2300/0015 ... HDPE
- E02D 2300/0017 ... thermoplastic
- E02D 2300/0018 .. Cement used as binder
- E02D 2300/002 ... Concrete
- E02D 2300/0021 ... Mortar
- E02D 2300/0023 ... Slurry
- E02D 2300/0025 .. Adhesives, i.e. glues
- E02D 2300/0026 . Metals
- E02D 2300/0028 .. Copper
- E02D 2300/0029 .. Steel; Iron
- E02D 2300/0031 ... in cast iron form
- E02D 2300/0032 ... in sheet form, i.e. bent or deformed plate-material
- E02D 2300/0034 ... in wire form

- E02D 2300/0035 .. Aluminium
- E02D 2300/0037 . Clays
- E02D 2300/0039 .. mixed with additives
- E02D 2300/004 .. Bentonite or bentonite-like
- E02D 2300/0042 ... being modified by adding substances
- E02D 2300/0043 ... with other ingredients
- E02D 2300/0045 . Composites
- E02D 2300/0046 . Foams
- E02D 2300/0048 .. PU
- E02D 2300/005 .. PE
- E02D 2300/0051 . Including fibers
- E02D 2300/0053 .. made from glass
- E02D 2300/0054 .. made from plastic
- E02D 2300/0056 ... PVC
- E02D 2300/0057 ... PE
- E02D 2300/0059 ... PP
- E02D 2300/006 ... being recycled
- E02D 2300/0062 Shredded car tires
- E02D 2300/0064 .. made from metal
- E02D 2300/0065 .. made from textile
- E02D 2300/0067 .. made from cellulose
- E02D 2300/0068 .. made from carbon
- E02D 2300/007 . Resins including glasfibers
- E02D 2300/0071 . Wood
- E02D 2300/0073 . Explosives
- E02D 2300/0075 . Textiles
- E02D 2300/0076 .. non-woven
- E02D 2300/0078 .. woven
- E02D 2300/0079 . Granulates
- E02D 2300/0081 . Ceramics
- E02D 2300/0082 . Cellulose
- E02D 2300/0084 . Geogrids
- E02D 2300/0085 . Geotextiles
- E02D 2300/0087 .. woven

- E02D 2300/0089 .. non-woven
- E02D 2300/009 .. with multi-layer structure
- E02D 2300/0092 ... including a liquid tight layer
- E02D 2300/0093 including bentonite
- E02D 2300/0095 including a plastic membrane
- E02D 2300/0096 .. with external friction enhancement features

- E02D 2300/0098 . Bitumen

E02D 2450/00

- E02D 2450/10 . Membranes
- E02D 2450/101 .. permeable
- E02D 2450/102 ... for liquids
- E02D 2450/103 ... for gases
- E02D 2450/105 .. impermeable
- E02D 2450/106 ... for liquids
- E02D 2450/107 ... for gases
- E02D 2450/108 .. multi-layered

E02D 2600/00 **Miscellaneous**

- E02D 2600/10 . comprising sensor means

- E02D 2600/20 . comprising details of connection between elements

- E02D 2600/30 . comprising anchoring details

- E02D 2600/40 . comprising stabilising elements